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Abstract

NEUTRON FLUX MEASUREMENTS IN A POOL TYPE LIGHT WATER-MODERATED RESEARCH REACTOR

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Measurements of thermal, epithermal and fast neutrons were carried out in the light water-moderated pool type reactor IRR-1. The purpose of these experiments was two-fold: evaluation of the thermal and epithermal neutron fluxes inside the core and the adjacent experimental facilities, and the study of the fast neutron spectral shape and its attenuation at various distances in the light water reflector.

The thermal and epithermal flux measurements were carried out using dysprosium foils as pure thermal detectors, and gold foils as mixed thermal and epithermal detectors. This technique was found to be simpler than other standard methods of flux measurement inside reactor cores, and yielded excellent agreement with these methods on the magnitude of the epithermal component.

The fast neutron spectra above 1 MeV were studied using fast neutron activation detectors. This method is the most convenient for fast neutron measurements inside reactors on account of its simplicity, adaptability and zero response to high γ fluxes. On the other hand, the wide energy response of each detector and the inaccuracy of the cross section data make the interpretation of the results difficult. Seven activation detectors were used, covering the region of about 1 to 15 MeV. The calculated spectrum was based on the simultaneous solution of the seven activation integrals.

The results indicate a hardening of the spectrum at increasing distances from the core. A dip in the spectrum between 3 and 4.5 MeV was observed at larger distances from the core and a smaller dip in the same region adjacent to the core. A slight hardening was also noted in the in-core spectrum as compared with a pure fission spectrum.